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FACTORS INFLUENCING THE DEVELOPMENT OF ASCARIS EGGS

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The White House,
103, St. Peters Street,
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165—Proceedings of the Helminthological Society of Washington.

q. ALICATA, J. E.—" Observations on the period required for *Ascaris* eggs to reach infectivity." 1 (1), 12. [1934.]

(q) Eggs of *Ascaris suum* containing embryos which had not moulted were not infective to guinea-pigs while those which had moulted were. As a number of ascarid and oxyurid embryos undergo a moult before hatching, Alicata suggests that the moult may be a feature which determines when the egg reaches the infective stage. R.T.L.

633—Radiation Research. New York.

a. BACHOFER, C. S. & PAHL, G., 1955.—" Influence of extended temperature treatments on recovery of X-irradiated Ascaris eggs." 2 (1), 50–63.

b. BACHOFER, C. S., 1955.—" Pronuclear fusion, cell cleavage, and embryogenesis of irradiated Ascaris eggs." [Abstract of paper presented before the Radiation Research Society, New York, May 16–18, 1955.] 3 (2), 212–213.

(633a) In 1939 Cook reported that if eggs of *Parascaris equorum* which had been X-irradiated were subsequently kept at 5°C. for long periods they showed a remarkable recovery. Bachofer & Pahl have now investigated the response of eggs of *Ascaris lumbricoides* from the pig to similar treatment. X-irradiation causes the first cleavage to be delayed and this delay is not altered by keeping the eggs at 0°C. or 5°C. for periods up to 35 weeks before incubating at 30°C. Subjection of the eggs to low temperatures before incubation resulted in fewer eggs completing embryogenesis, suggesting that this is controlled by a different mechanism. Irradiated eggs were more sensitive than normal eggs to temperatures above the optimum (30°C.). S.W.

(633b) Bachofer exposed Ascaris ova to irradiation with ultra-violet and X-rays and found that it caused considerable delay in the initiation of pronuclear fusion and cell cleavage and, in some doses, prevented the completion of embryogenesis. Sharp differences in the effects of the two types of irradiation were observed, the X-rays having a much more marked effect on the inhibition of embryogenesis than did the ultra-violet. Experiments on possible recovery mechanisms indicated that deoxygenation and incubation for 24 hours after irradiation, before aerobic incubation, would shorten the time required for the fusion of the pronuclei and commencement of cleavage and increase the percentage of ova completing embryogenesis. S.W.

172—American Midland Naturalist.

a. BACHOFER, C. S., 1957.—" Effects of ionizing and non-ionizing radiations on pronuclear fusion, cleavage, and embryogenesis of Ascaris eggs." 58 (1), 155–169.

(172a) Bachofer's studies showed that X-rays and ultra-violet irradiation of the eggs of *Ascaris lumbricoides suum* caused delay in the fusion of pronuclei, first cell cleavage and development of ova into motile embryos and revealed that deoxygenation and incubation for 24 hours after irradiation before aerobic incubation shortened the time required. His experiments indicate that probably the anerobic synthesis of proteins and other substances may be necessary for recovery of the damaged cell. R.T.L.

452—Journal of the Royal Microscopical Society.

a. BEAMS, H. W. & KING, R. L., 1940.—" The air-driven ultracentrifuge: its application in biology, together with some effects of ultracentrifuging the eggs of *Ascaris suum*." Series 3, 60 (4), 240–256.

4022—BELYAEVA, A. A., 1969. [Experimental photoreactivation of *Ascaris suum* eggs.] *Problemy Parazit.*, Year 1969, Part I, pp. 51–52. [In Russian.]

In an evaluation of the use of ultra-violet irradiation for the control of helminth ova, it was shown that subsequent exposure to visible light partially alleviated the lethal effect, allowing further development of a proportion of the eggs. G.I.P.

669—BIZIULEVIČIUS, S., 1960. [On the resistance of *Ascaris lumbricoides* and *Trichuris trichiura* eggs to various environmental factors.] *Acta parasit. lith.*, **2** (2), 39–54. [In Russian: German & Lithuanian summaries pp. 39–40 & 53–54.]

670—BIZIULEVIČIUS, S., 1960. [Survival and development of *Ascaris lumbricoides* and *Trichuris trichiura* eggs in the soil.] *Acta parasit. lith.*, **2** (2), 115–140. [In Russian: German & Lithuanian summaries pp. 115–116 & 138–140.]

783—BIZIULEVIČIUS, S., 1961. [On the viability of *Ascaris lumbricoides* and *Trichuris trichiura* eggs in compost heaps.] *Acta parasit. lith.*, **3**, 51–69. [In Russian: English & Lithuanian summaries pp. 68–69.]

785—BIZIULEVIČIUS, S., 1962. [Study of the effect of the intensity of sun radiation on viability of *Ascaris lumbricoides* and *Trichuris trichiura* eggs.] *Acta parasit. lith.*, **4**, 147–160. [In Russian: English & Lithuanian summaries pp. 158–160.]

671—BIZIULEVIČIUS, S., 1965. [Effect of temperature (above and below zero) and drying on the egg viability of *Ascaris* and *Trichuris* under laboratory conditions.] *Acta parasit. lith.*, **5**, 19–39. [In Russian: English & Lithuanian summaries pp. 37–39.]

786—BIZIULEVIČIUS, S., 1965. [Effect of chemicals on the viability of eggs of *Ascaris lumbricoides* and *Trichuris trichiura*.] *Acta parasit. lith.*, **5**, 41–75. [In Russian: English & Lithuanian summaries pp. 73–75.]

787—BIZIULEVIČIUS, S., 1965. [Studies on the viability of *Ascaris* and *Trichuris* eggs in buried lavatory pits.] *Acta parasit. lith.*, **5**, 77–84. [In Russian: English & Lithuanian summaries pp. 83–84.]

1910—BIZIULEVIČIUS, S. K., 1968. [Survival and development of *Ascaris lumbricoides* and *Trichuris trichiura* eggs in soil in the Lithuanian SSR.] [Papers on helminthology presented to Academician K. I. Skryabin on his 90th birthday.] *Moscow: Izdat. Akad. Nauk SSSR*, pp. 11–13. [In Russian.]

505—Archiv für Experimentelle Veterinärmedizin.

a. BORCHERT, A. & KALBE, I., 1955.—" Über die Widerstandsfähigkeit der Eier von *Ascaris lumbricoides* L. bei der natürlichen Kompostierung." **9** (1), 142–144.

(505a) Borchert & Kalbe have investigated the survival of *Ascaris lumbricoides* eggs in compost made from city and slaughterhouse refuse in two compost works in the neighbourhood of Berlin. The compost was prepared by stacking the refuse over poles, which were later withdrawn to allow ventilation, and natural rotting was induced by fungi, bacteria and earthworms. The heaps were turned over after several weeks. When *Ascaris* eggs and mature worms were placed in specified parts of the heaps and examined daily they decomposed in four to ten days indicating that the compost was safe as manure. M.McK.

3920—BRUDASTOV, A. N., KRASNONOS, L. N., LEMELEV, V. R. & KHOLMUKHAMEDOV, Sh. Kh., 1970. [Infectivity of *Ascaris lumbricoides* eggs to man and guinea-pigs after 10 years in the soil.] *Medskaya Parazit.*, 39 (4), 447–451. [In Russian: English summary p. 451.]

The authors demonstrated by experimental infection of guinea-pigs and themselves that the infectivity of fertilized eggs of *Ascaris lumbricoides*, which were buried in garden top soil for 10 years in USSR (Central Asia), was 6·9% in guinea-pigs and 38·8% in man. N.M.L.

2123—BUCHWALDER, R., 1966. "Untersuchungen über ektogene Helminthenstadien. 4. Die Wirkung physikalischer Einflüsse auf die Eier von *Ascaris suum*." *Angew. Parasit.*, **7** (3), 202–207. [English & Russian summaries p. 207.]

3187—BUTS, F. I., 1969. [Survival of *Ascaris lumbricoides* eggs in the soil of three zones of the Adyge region of the Krasnodar Territory.] *Medskaya Parazit.*, **38** (2), 241–242. [In Russian: English summary p. 242.]

2176—CHUBIS, A. I., 1965. [Development and survival of pig *Ascaris* in natural conditions in south-eastern Kazakh SSR.] *Trudȳ tselin. kraev. nauchno-issled. vet. Sta.*, pp. 168–183. [In Russian.]

Ascaris eggs, placed in surface crevices or in soil at depths of 3 and 10 cm, in animal yards in the autumn (October), remained viable throughout the winter and developed to larvae by midsummer. Eggs remained viable for more than a year within the soil. R.S.S. [Trans.G.I.P.]

254—COSTELLO, L. C., 1964. "The comparative biochemistry of developing *Ascaris* eggs. III. Flavin adenine dinucleotide extracted from unembryonated eggs." **Experimental Parasitology. New York, 15** (1), 1–6.

Costello showed that butanol extracts of homogenates of unembryonated eggs of *Ascaris lumbricoides* showed a fluorometric spectrum similar to flavin. Aqueous extracts of the homogenates stimulated the activity of D-amino acid oxidase. Most of the flavin adenine dinucleotide in the extracts was protein-bound. Electrophoretic studies showed that almost all the flavin was in the form of the adenine dinucleotide; no riboflavin or flavin mononucleotide could be detected. W.P.R.

096—COSTELLO, L. C., 1966. "Changes in catalase activity during embryonation of *Ascaris* eggs, and its relationship to respiration and cytochrome oxidase activity." [Abstract.] *Int. Congr. Parasit.* (1*st*), *Rome*, Sept. 21–26, 1964. Proceedings, Vol. I, p. 71.

40—COSTELLO, L. C. & BROWN, H., 1962. "Aerobic metabolism of unembryonated eggs of *Ascaris lumbricoides*." **Experimental Parasitology. New York, 12** (1), 33–40.

Costello & Brown found that homogenates of unembryonated eggs of *Ascaris lumbricoides* (pig strain) had a Qo_2 of 0·16 to 0·18. By means of the Thunberg technique and manometry, enzymes of the Krebs cycle were found to be present. W.P.R.

078—COSTELLO, L. C. & OYA, H., 1963. "Cytochrome c oxidase activity in developing *Ascaris* eggs." [Abstract.] **Journal of Parasitology, 49** (5, Sect. 2), 50–51.

A brief account of this work also appeared in *Int. Congr. Zool.* (*16th*), 1963, Proceedings, Vol. 2, p. 300; for abstract see Helm. Abs., **33**, No. 2956.]

955—COSTELLO, L. C., OYA, H. & SMITH, W., 1963. "The comparative biochemistry of developing *Ascaris* eggs. I. Substrate oxidation and the cytochrome system in embryonated and unembryonated eggs." **Archives of Biochemistry and Biophysics, 103** (3), 345–351.

Costello *et al.* found that homogenates of unembryonated eggs of *Ascaris* from pigs oxidized both succinate and malate. The oxidation of succinate was antimycin-sensitive and of malate antimycin-insentive. The oxidation of these substrates led to the reduction of cytochrome *c* but cytochrome oxidase was absent, so the authors suggest that electron transport involves flavin adenine dinucleotide and its oxidase. Embryonated eggs contained cytochrome *c* oxidase and the oxidation of succinate and malate in homogenates of these eggs involved this enzyme. W.P.R.

2956—COSTELLO, L. C., OYA, H. & SMITH, W. N., 1963. "Cytochrome c oxidase and respiration in embryonated and unembryonated *Ascaris* eggs." [Abstract.] **International Congress of Zoology (16th)**, Washington, August 20-27, 1963. Proceedings, Vol. 2, p. 300.

Cytochrome oxidase is associated with respiration in the embryonated (infective) eggs of *Ascaris* but the enzyme could not be demonstrated in unembryonated (one-cell stage) eggs. Anaerobic activities may occur in the unembryonated eggs. H.H.W.

667—COSTELLO, L. C. & SMITH, W., 1964. "Comparative biochemistry of developing *Ascaris* eggs. IV. Enzymic hydrolysis of ATP by unembryonated eggs." *Expl. Parasit.*, **15** (5), 381–386.

A major portion of the adenosine triphosphatase activity of unembryonated eggs of *Ascaris lumbricoides* var. *suum* was associated with a particulate fraction separated at 10,000 g. The enzyme was similar to that of mammalian mitochondria. W.P.R.

2890—COSTELLO, L. C. & SMITH, W., 1964. "The comparative biochemistry of developing *Ascaris* eggs. V. Changes in catalase activity during embryonation." *Archs Biochem. Biophys.*, **106** (1/3), 223–228.

Catalase activity in homogenates of eggs of *Ascaris lumbricoides* was measured by manometric, spectrophotometric and titrimetric methods. The activity (μ moles H_2O_2 decomposed per min. per mg. protein) in fertilized one-cell eggs was constant at 30 until the first larval stage was reached when activity fell to 16. At the moult the value rose rapidly to 54. The relation between catalase, cytochrome oxidase and respiration, and the function of catalase in the embryonation of eggs is discussed. W.P.R.

3472—COSTELLO, L. C., SMITH, W. & FREDERICKS, W., 1966. "The comparative biochemistry of developing *Ascaris* eggs. VI. Respiration and terminal oxidation during embryonation." *Comp. Biochem. Physiol.*, **18** (1), 217–224.

Cytochrome-*c* oxidase was not involved in the endogenous respiration of homogenates of fertilized eggs of *Ascaris* at the single cell stage. Both cyanide and azide inhibited respiration and the rate of reduction of cytochrome-*c* was not affected. Homogenates of the gastrula stage showed cytochrome oxidase activity but the rate of cytochrome-*c* reduction exceeded oxidation. Homogenates of embryonated eggs also showed cytochrome oxidase activity and added cytochrome-*c* was maintained in a partially oxidized state rather than completely reduced as it was with other developmental stages. However, carbon monoxide inhibited cytochrome-*c* oxidase without affecting respiration. Oxygen-uptake/pO_2 relationship supported the view that a flavin-mediated terminal oxidase was important in unembryonated eggs whereas cytochrome-*c* oxidase was important in the embryonated form. W.P.R.

1841—COSTELLO, L. C., SMITH, W. & OYA, H., 1967. "The comparative biochemistry of developing *Ascaris* eggs. VII. Malate oxidation and metabolism in unembryonated eggs." *Comp. Biochem. Physiol.*, **21** (1), 161–170.

Dialysed homogenates of unembryonated eggs of *Ascaris* oxidized malate in the presence of added NAD and a hydrogen acceptor, with the production of oxaloacetate and pyruvate. Direct evidence of malate dehydrogenase was obtained. Pathways resulting in the decarboxylation of malate were not identified but the presence of malic enzyme was indicated. In addition to oxidation, malate was metabolised to fumarate and succinate. The significance of these results in relation to the general metabolism of the eggs is discussed. W.P.R.

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12—Comptes Rendus des Séances de l'Académie des Sciences.

b. DOGNON, A.—"Action de rayons X monochromatiques de longuer d'onde différente sur l'oeuf d'Ascaris." CXCVI (6), 437-438. [1933.]

(b) Dognon has continued his work on the action of monochromatic X-rays on eggs of Ascaris [see Helm. Abs. I, No. 117*a*], and now finds that rays of wave-length 3·8-4 Å.V. are more lethal than those of 1·54 Å.V., on the assumption that the sensitive material of the egg is a negligible volume located at the centre, i.e., the nucleus. B.G.P.

224—Experimental Parasitology. New York.

e. FAIRBAIRN, D., 1957.—"The biochemistry of *Ascaris*." 6 (5), 491–554.

(224e) Fairbairn presents a comprehensive review of our present knowledge of the chemistry, physiology and biochemistry of *Ascaris lumbricoides* of the pig and *Parascaris equorum*, including a short account of the techniques used in such work. Under the heading "Chemistry" he deals with the carbohydrates, lipids and proteins. In the first half of the section on physiology the adult parasites are discussed with reference to feeding, digestion and absorption, excretion, permeability to water, salts and anthelmintics, resistance to proteases, toxic substances, antigens and immunity, respiration and fermentation, carbohydrate metabolism and biological oxidations, lipid metabolism and nitrogen metabolism. In the second half of this section Fairbairn considers the egg, spermatogenesis and oogenesis, fertilization, properties and function of the egg-shell and the biochemistry of embryonation. There is an extensive bibliography. S.W.

3299—FOOR, W. E., 1967. "Ultrastructural aspects of oocyte development and shell formation in *Ascaris lumbricoides*." *J. Parasit.*, 53 (6), 1245–1261.

During the developmental stages of the oocytes of *Ascaris lumbricoides* (while they are still attached to the axial rachis by cytoplasmic bridges) various organelles and granules appear in the cytoplasm. The development of the largest of these—membrane-bounded refringent granules—is traced (21 photomicrographs) and they are shown to contain ascaroside esters on "maturation". After oocyte fertilization the refringent granules are extruded from the cytoplasm and coalesce to form the third (ascaroside) layer of the ovum. [A.S.] P.S.G.

1329—FUKUNISHI, T., 1961. [Studies on the distribution and development of eggs of *Ascaris lumbricoides* in the soil. I. The distribution of *Ascaris lumbricoides* in soil of rural vegetable gardens, the residential districts and the playground of schools, and on the seasonal rise and fall of eggs of *Ascaris lumbricoides* in soil of rural vegetable gardens.] **Race Hygiene. Tokyo, 27** (3), 220–240. [In Japanese: English summary pp. A13–A14.]

The distribution of *Ascaris lumbricoides* eggs in the soil and I.F.D. (total index value of frequency of detection) were studied. Most eggs were found in rural vegetable fields, the playgrounds of primary schools in isolated places (with about half the rate of the vegetable fields), and the fewest in kitchen gardens of private homes. The author concludes that the chance of infection of the soil with eggs in the rural vegetable gardens was highest in spring, July and autumn. Spring was especially noted for high infection rates, which were quite low by midsummer. Y.Y.

1330—FUKUNISHI, T., 1961. [Studies on the distribution and development of eggs of *Ascaris lumbricoides* in the soil. II. On the effect of sunshine on eggs of *Ascaris lumbricoides* in the soil.] **Race Hygiene. Tokyo, 27** (3), 240–261. [In Japanese: English summary pp. A14–A15.]

In summer, during periods of drought, the eggs of *Ascaris lumbricoides* in soil developed at the same speed as in other seasons in spite of the longer hours of sunshine. Most, except those in the shade, died within one month. The eggs developed quite rapidly even with fewer hours of sunlight from midsummer to early autumn. Y.Y.

57—Zeitschrift für Parasitenkunde.

a. GERMANS, W., 1954.—" Laboratoriumsuntersuchungen über die Resistenz der Eier des menschlichen Spulwurmes *Ascaris lumbricoides* L." **16** (2), 93–110.

(57a) Germans' paper, which is a summary of his inaugural dissertation at Marburg University, gives the results of his laboratory experiments on the resistance of *Ascaris lumbricoides* ova to physical, chemical and biological influences. He confirms that ova are particularly resistant to physical factors, the only exceptions being high temperatures (embryonated ova were killed within two hours at 45°C. and within half an hour at 50°C.) and lack of moisture (ova were affected if the water content of soil was less than 6%). Germans tabulates the results obtained by earlier workers with chemicals; the figures show that only phenol and carbon disulphide kill Ascaris ova quickly, but both substances are too toxic to plant life to be used for control purposes. The author's own experiments show that neither proteolytic enzymes, santonin, ascaridole nor chenopodium oil have any effect on Ascaris ova. From experiments with lettuce plants Germans concludes that ova can be removed from green vegetables by placing them in a suitable wetting agent and then shaking the plants thoroughly or rinsing them in running water. A.E.F.

2629—GLIKINA, E. L., 1961. [Kafedra biologii, Kubanski meditsinski institut, U.S.S.R.] [Study of the periods of development and survival of *Ascaris* and *Trichuris* eggs in the soil of Krasnodar.] **Gigiena i Sanitariya. Moscow, 26** (2), 107–109. [In Russian.]

465—Meditsinskaya Parazitologiya i Parazitarnie Bolezni. Moscow.

q. GORDON, E. I., 1956.—[The rate of development of *Ascaris lumbricoides* ova at various temperatures.] **25** (3), 234–238. [In Russian.]

(465q) Gordon has plotted the speeds of development (S) of *Ascaris lumbricoides* eggs to the stage of a formed larva against effective temperatures (T) and, using Bodenheimer's formula for malarial mosquitoes $S=\frac{C}{T-t^{\circ}}$, has found the lowest temperature level for development (t°) to be 10·3°C., while the sum of degree-days or "sum of heat" (C) necessary for the completion of development, varied between 140 and 200. Development at 23°C. to 26°C. when interrupted at any stage of larval formation for 6 to 23 days at 0°C. to 4°C., for 32 to 69 days at −1°C. to −5°C., and for 29 days at −9°C. to −12°C., was completed after the eggs had experienced a number of warm days more or less equal to that of uninterrupted development (12 to 16 days). After 90 days of freezing at −12°C. to −15°C. only eggs at the one blastomere stage continued their development and only 10% of them completed it in the normal period of warm days. G.I.P.

2105—GORYACHEV, P. P., 1963. [The effect of the root system of some plants on the embryonic development of *Ascaris* and the hatching of larvae from eggs.] In: [Helminths of man, animals and plants and their control: Papers on helminthology presented to Academician K. I. Skryabin on his 85th birthday.] *Moscow: Izdatelstvo Akad. Nauk SSSR*, pp. 257–259. [In Russian.]

It was shown experimentally that the embryonic development of pig *Ascaris* was twice as quick in media containing root exudate of wheat and oats than in controls. G.I.P.

687—GORYACHEV, P. P., 1964. [The effect of gibberellin on the embryonic development of *Ascaris suum*.] *Medskaya Parazit.*, **33** (3), 297–300. [In Russian: English summary p. 300.]

The author studied the effect of gibberellin on the development of eggs of *Ascaris suum*. The eggs were extracted from female worms and kept in a solution containing 250 mg. of NaH_2PO_4, 200 mg. of KNO_3, 60 mg. of $MgSO_4$, 60 mg. of $Ca(NO_3)_2$ and traces of $FeCl_3$ in 1,000 ml. of distilled water. Gibberellin was added to the solution in various proportions from 1:1,000 to 1:2,000,000. 10 different concentrations were prepared. Their effects on the development of eggs is shown in a table. Eggs in the solution without gibberellin were kept as controls. Gibberellin has a stimulant effect and the eggs of *A. suum* develop 5 times faster than eggs kept in the control solution. S.M.

2100—GRZYB, Z. S., 1964. "Wpływ wyciągów porostowych na żywotność i tempo rozwoju jaj *Ascaris*." **Wiadomości Parazytologiczne, 10** (1), 69–77. [English summary pp. 76–77.]

Grzyb tested the effect of extracts of 5 species of lichens on the development of mature *Ascaris suum* eggs. In acid solution the development of eggs in the extracts was similar to that of controls, except in that of *Xanthoria parietina* when it stopped at the blastula stage. Extracts in water, buffer solution and in alkaline solution all inhibited or slowed down the rate of development of the eggs. The author concludes that the ovicidal effect of lichen extracts is relatively insignificant. J.H.B.

336—GRZYB, Z. & SZYDŁOWSKA, T., 1964. "Direct and indirect effect of antibiotics on the development of *Ascaris* eggs cultured together with *Escherichia coli* and *Proteus mirabilis*." **Acta Parasitologica Polonica, 12** (1/12), 77–84. [Polish summary pp. 83–84.]

The development of pig *Ascaris* eggs in the presence of an antibiotic (streptomycin, chloromycetin or oxytetracycline) and/or a bacterium (*Escherichia coli* or *Proteus mirabilis*) was investigated. In the presence of an antibiotic only, optimal development took place in 6·0 µgm./ml. streptomycin, 0·1 µgm./ml. chloromycetin or 0·8 µgm./ml. oxytetracycline. 12·5 µgm./ml. streptomycin and 50 µgm./ml. oxytetracycline had an adverse effect on development but not when a bacterium was present. In the presence of both antibiotic and bacterium, optimum development of the eggs took place when the amount of antibiotic was half that required to inhibit the growth of the bacterium. J.W.S.

1151—GUDZHABIDZE, G. S. & PREOBRAZHENSKAYA, T. P., 1959. [Institut malyarii, meditsinskoi parazitologii i gelmintologii, Ministerstvo zdravookhraneniya SSSR.] [The effect of Actinomycetaceae, fungi and bacteria isolated from the soil of fields manured by sewage on the eggs of *Ascaris suum*.] **Meditsinskaya Parazitologiya i Parazitarnie Bolezni. Moscow, 28** (4), 400–405. [In Russian: English summary p. 405.]

To test the influence of certain bacteria and fungi from the soil of a sewage farm on *Ascaris suum* eggs, a number of egg cultures with species of *Penicillium* and *Alternaria*, 15 species of *Actinomyces* and 9 unidentified bacteria were set up. Most of the micro-organisms proved harmless, but *A. olivaceus* and three of the bacteria were capable of retarding the development of the eggs and lowering their infectivity (tested on mice). Thus their possible use in biological control should be borne in mind. G. I. Pozniak

59—Revista Ibérica de Parasitología.

d. GUEVARA POZO, D., 1959.—" Las fases iniciales en el desarrollo del *Ascaris lumbricoides* del cerdo. II. Experiencias sobre la viabilidad de los huevos y formación del embrión." **19** (2), 113–122.

(59d) Guevara Pozo investigated the development and viability of the eggs of *Ascaris lumbricoides*. The eggs were hatched in 1% formol solution at 31·5°C. and the results tabulated. It is concluded that: (i) practically all the eggs which were near the vulva reached the embryonic stage; (ii) at the distance of 4 cm. from the vulva 95% reached that stage, whereas only 13% to 15% of those placed in the middle part of the uterus became embryonated; (iii) none of the eggs near the oviducts were found to develop; (iv) eggs extracted from the middle part of the uterus, and which had become embryonated took the normal time to develop to the embryonic stage plus the time which would be needed for their natural expulsion; (v) eggs extracted from the posterior part of the uterus matured more quickly than those that were left in it, possibly on account of the need of oxygen by the eggs during the process of segmentation; (vi) early embryonation occurred simultaneously with, but was independent of, membrane formation while the eggs were still in the uterus. N.J.

493—Cytologia.

a. HIRSCH, G. C. & BRETSCHNEIDER, L. H., 1937.—"Die Arbeitsräume in den Darmzellen von Ascaris; die Einwirkung des Hungerns; die Sekretbildung." Fujii Jubilaei Volumen, pp. 424-436.

486—Peking Natural History Bulletin.

d. HSU, Y. C., & HSU, H. S., 1940.—"Effects of chemical reagents on the development of eggs in *Ascaris lumbricoides* Linn." 15 (2), 103–118.

(486d) Hsu & Hsu have studied the effects of certain reagents on the development of *Ascaris lumbricoides* eggs. Phenol, which was effective in 1% solution, was the best ovicide examined. Sulphuric acid and nitric acid solutions were toxic above a 1% concentration but eggs developed fairly normally in acetic acid, hydrochloric acid and formalin solutions up to 10%. Sodium hydroxide was more toxic than the acids. It is considered that the effects of the chemicals on the eggs was largely determined by the permeability of the egg coverings. The optimum developmental temperature was 30° to 34° C. Eggs would not hatch at temperatures above 32° C. W.P.R.

597—Proceedings of the Society for Experimental Biology and Medicine.

a. HUFF, G. C. & BOELL, E. J., 1936.—"Effect of ultracentrifuging on oxygen consumption of the eggs of *Ascaris suum*, Goeze." 34 (5), 626-628.

(597a) Huff & Boell have determined the respiratory rate of eggs of *Ascaris suum* after centrifuging for 30 minutes at a force of 150,000 times gravity. They found that the oxygen uptake was much less than that of normal eggs, but the results indicated a partial recovery after 2 hours and complete recovery after 24 hours. A solution of 10^{-3}M. KCN markedly depressed the respiration of normal eggs, maximal inhibition being obtained within 2 hours. Previous centrifuging of the eggs had no effect on the action of KCN. The cleavage rate in centrifuged eggs was not noticeably different from that in normal eggs. R.H.H.

3926—IVANCHENKO, P. L. ET AL., 1969. [Survival of eggs of certain species of geohelminths depending on their depth in the soil.] *Problemy Parazit.*, Year 1969, Part I, pp. 107–108. [In Russian.]

[*Ascaris lumbricoides* and *A. suum* eggs.]

502—IWAŃCZUK, I. & DOŻAŃSKA, W., 1959. "Badania nad wpływem różnych związków chloru czynnego na przeżywalność jaj *Ascaris* w zależności od pH i potencjału oksydacyjno-redukcyjnego." [Results of research on the influence of various compounds of available chlorine on the survival of eggs of *Ascaris* in relation to *p*H and the oxidation-reduction potential.] **Roczniki Panstwowego Zakładu Higieny. Warsaw, 10** (6), 547–557. [English & Russian summaries pp. 556–557.]

1490—Japanese Journal of Medical Science and Biology.

*a. IZUMI, S., 1953.—"Biological studies on *Ascaris* eggs. IV. *Ascaris* ontogenesis observed by nucleic acid stainings, and distribution of fat or glycogen following the development of *Ascaris* eggs." 6 (4), 371–383.

*b. IZUMI, S., 1953.—"Biological studies on *Ascaris* eggs. V. On the staining reactions of *Ascaris* eggs to phosphor, calcium and some other substances in the process of their oögenesis." 6 (4) 385–388.

410—Japanese Journal of Medical Science and Biology. [Cont. of Japanese Medical Journal.]

a. IZUMI, S. & NAKAMURA, S., 1952.—"Biological studies on Ascaris eggs. I. Comparative study of various culture methods of Ascaris eggs." 5 (1), 7–12.

(410a) Tabulated results show that Ascaris eggs develop very similarly when cultured on moistened Japanese tiles, clay plates, sand, and filter paper but glass test-tubes were less satisfactory in the earlier and more so in the later period of the culture. The addition of 2% formalin to the cultures proved of little advantage except for those made in glass test-tubes. When pulverized animal charcoal was used the specimens were too much obscured to be studied. R.T.L.

337—Journal of Parasitology

†ca. JASKOSKI, B. J., 1950.—"The role of the protein coat in the development of the ova of *Ascaris lumbricoides* var. *suum*." 36 (6, Sect. 2), Suppl. p. 33.

(337ca) Of certain commercial detergents which completely inhibited cleavage in the ova of *Ascaris lumbricoides*, a combination of 5% Duponol 80 plus 1% phenol was the most effective. The inhibitory effect was enhanced by a temperature above 31·1°C. 5% Duponol 80 was the most effective solution tested to induce *in vitro* hatching. R.T.L.

451—Journal of Parasitology

†ba. JASKOSKI, B. J., 1951.—"Effects of detergents on embryogeny of *Ascaris lumbricoides* var. *suum*." 37 (5, Sect. 2), Suppl. p. 22.

(451ba) The length of the alkyl chain and the complexity of a detergent mixture are apparently important factors in the inhibitory action of certain synthetic an-ionic wetting agents on the cleavage of ova of *Ascaris lumbricoides* var. *suum*. The most effective appeared to be those which in some way increased the permeability of the egg shell. Duponol 80, Aresklene 400, Areskap 100 and Aresket 375 completely inhibited cleavage. The efficiency of those which normally contained no phenol was increased by the addition of 1% phenol, but there appeared to be no correlation between the reduction in surface tension and the inhibition of cleavage. R.T.L.

1859—JEZYK, P. F. & FAIRBAIRN, D., 1969. "Quantitative aspects of lipid utilization during embryogenesis of *Ascaris suum* eggs." *J. Parasit.*, 55 (3), 477–479.

Quantitative aspects of fatty acid utilization during embryogenesis of *Ascaris suum* eggs are reported. The decrease in total lipid content paralleled very closely that found in previous observations [see *Helminth. Abstr.*, 26, No. 205a]. Lipid decrease could be accounted for almost completely by the loss of triglycerides and lipids with chromatographic mobility greater than triglycerides. Results indicate that the amounts of branched-chain volatile and odd-carbon fatty acids utilized can only account for a small part of the synthesized carbohydrate. M.B-B.

1223—KAKACHEVA-AVRAMOVA, D. & KARATOTEVA, T. I., 1958. [Action of ultra sound on eggs of *Ascaris suum* and *Fasciola hepatica*.] *Izv. tsent. khlemint. Lab., Sof.*, 3, 99–108. [In Bulgarian: French & Russian summaries pp. 106–108.]

Treatment with ultra sound at 7 W per sq. cm. for 50 min. killed 93% of pig *Ascaris* eggs and 94% of *Fasciola hepatica* eggs in water. Destruction of all eggs was not possible with the apparatus used, as 7 W per sq. cm. was the maximum intensity. Surviving eggs developed to the infective stage (*Ascaris*) or free miracidium (*Fasciola*). The sensitivity of *Ascaris* eggs did not vary greatly at different stages of development; that of *Fasciola* eggs increased progressively, the free miracidia being the most sensitive, dying within 10 sec. [From Russian summary.] G.I.P.

505 – Archiv für Experimentelle Veterinärmedizin

c. KALBE, I., 1955.—"Untersuchungen über die Entwicklungsfähigkeit der Eier von *Ascaris lumbricoides* L. und *Parascaris equorum* Goeze nach Abwasseraufenthalt und unter anderen biologischen Bedingungen." 9 (4), 557–568.

(505c) Fertilized but unembryonated eggs of *Parascaris equorum* and of *Ascaris lumbricoides* from the pig were placed in waste city water (*p*H 7·5 in the absence of oxygen) or in the sedimented slime in three-litre containers. As the sojourn of the eggs increased from 7 to 61 days there was a greater mortality and an increasing delay in subsequent development, these effects being more marked when the containers were in the open than when in the laboratory. The mortality did not reach 100%. Embryonated eggs were more resistant than unembryonated eggs and those of *P. equorum* withstood conditions better than those of *A. lumbricoides*. When kept at 4°C., the viability of unembryonated eggs of both species was lost in about 20% after one day and in about 60% after 28 days. At −4°C., six days' sojourn destroyed completely the viability of unembryonated *P. equorum* eggs but if this freezing was interrupted daily for an hour, all viability was destroyed in seven days. Unembryonated eggs which still developed after freezing were not infective but those which developed after the water and slime treatment, did remain infective. M.McK.

309—KAWAZOE, Y., 1961. [Studies on physiological aspects of *Ascaris lumbricoides* at early developmental stages. I. Oxygen consumption of eggs at various developmental stages and of larvae hatched *in vitro*.] **Japanese Journal of Parasitology, 10** (1), 26–34. [In Japanese: English summary p. 34.]

The oxygen consumption of eggs of *Ascaris lumbricoides* from pigs and of larvae hatched *in vitro*, was measured by Warburg's respirometer at various developmental stages. The oxygen consumption at the one-cell stage was affected neither by *p*H nor by the addition of sugar as a substrate. The optimum temperature for oxygen uptake was 37·5°C. At the two-cell stage, the oxygen uptake decreased to approximately two-thirds of that of the one-cell stage; this was followed by a rapid increase at later developmental stages. The maximum uptake was at the tadpole stage, being twice as much as that at the initial stage. Immediately after the larva was formed in the egg the oxygen consumption decreased rapidly; thereafter it continued to decline rather slowly. The hatched larva consumed oxygen actively, using more than three times as much as did embryonated eggs incubated for the same period. The optimum *p*H of the hatched larvae for oxygen uptake was shown to be 7·0. Among the 12 carbohydrates examined as a substrate, glucose stimulated oxygen consumption most actively.

Y.Y.

2022—KIZEVALTER, I. S. & DEREVITSKAYA, V. V., 1966. [Periods of development and survival of *Ascaris* eggs in different soils and climatic conditions in the Moscow region.] *Medskaya Parazit.*, 35 (2), 131–135. [In Russian: English summary p.135.]

1426—KMETEC, E., BEAVER, P. C. & BUEDING, E., 1963. "Succinoxidase activities and cytochrome oxidase of extracts of *Ascaris* eggs." **Comparative Biochemistry and Physiology, 9** (2), 115–120.

Kmetec *et al.* examined homogenates, from which large particles had been removed by centrifuging at low speeds (125 *g*. 1 min.), prepared from eggs of *Ascaris lumbricoides*. These preparations oxidized ferrocytochrome-c by a cyanide-sensitive reaction; in the presence of succinate, ferricytochrome-c was reduced and cyanide significantly increased this reaction. The results obtained with eggs cultured aerobically (for up to 120 days) and anaerobically (for up to 64 days) were similar and indicate that the cytochrome system was present in the early stages of the development of the eggs and that the capacity to oxidise succinate via the cytochrome system persisted under anaerobic conditions. The activities of both cytochrome-c and cytochrome oxidase were sufficiently high to account for the rate of oxygen uptake in intact eggs.

W.P.R.

192—Zeitschrift für Vergleichende Physiologie.

a. KREUZER, L., 1954.—"Zur Kenntnis der physikalisch-chemischen Eigenschaften der Eihülle von *Ascaris lumbricoides*. II. Mitteilung." **36** (1), 21–26.

(192a) Kreuzer exposed single-celled eggs of *Ascaris lumbricoides* to 1:10,000 "Acridine orange" in phosphate buffers and examined distribution and condition of the pigment in the egg membranes microscopically. A strong electro-absorptive capacity was shown by the outer and upper albuminoid membranes; the inner layer showed selective lipoid solubility. The author attributes the resistance of the eggs of *Ascaris* to a combination of the physico-chemical properties of the membranes.

W.P.R.

1895—LEE, O. R., YUN, B. H. & CHOI, W. Y., 1970. [Experiments on the infectivity to mice of *Ascaris* eggs irradiated with Cobalt^{60}.] *Korean J. Parasit.*, 8 (3), 90–95. [In Korean: English summary p. 95.]

Ascaris eggs irradiated with Co^{60} developed poorly. 36% of eggs irradiated with 200,000 rad developed to the morula stage in 4 weeks, but with 1,000,000 rad only 7% reached the same stage. The minimum dose of Co^{60} irradiation effective for preventing infectivity in mice was estimated to be 200,000 rad. [From English summary.]

C.W.G.

4—Medical Parasitology and Parasitic Diseases.

g. LONGINOV, A. N., 1940.—" Développement des oeufs de l'*Ascaris lumbricoides* dans les gisements de tourbe de Markovo-Sbornoïe de la région d'Ivanovo." 9 (5), 441–443. [In Russian.]

(464g) During the summer months Ascaris ova developed in red peat (which is dryer warmer) in one month; in black peat (moister but colder) in 2 months. By comparison, mineral soil (dryer and warmer than peat) Ascaris ova developed in 1½ to 3 months.

A.E.F.

7—Medical Parasitology and Parasitic Diseases.

i. LONGINOV, A. N., 1943.—[Development of *Ascaris lumbricoides* ova in the soil of Ivanova city.] 12 (3), 86–87. [In Russian.]

(357i) Longinov found in Ivanova city that the eggs of *Ascaris lumbricoides* mixed with erent types of soil and buried at various depths in a shady position reach the infective stage iin 3 months from the beginning of May, 2 months from June to July, and one to one and alf months from the beginning of August.

C.R.

1—LÝSEK, H., 1963. "Effect of certain soil rganisms on the eggs of parasitic roundworms." Correspondence.] **Nature. London, 199** 4896), 925.

l organisms, especially Acari, inhibit the develop- nt of *Ascaris* eggs or even destroy them. Various cies of fungi and soil bacteria also penetrate and troy the eggs leaving only thin deformed -shells but in artificial media they soon lose ir biological activity.

R.T.L.

—LÝSEK, H., 1968. "Developmental ano- alies and their induction in eggs of *Ascaris mbricoides*." *Věst. čsl. Spol. zool.*, 32 (3), 23–226.

elopmental anomalies were induced in the eggs *Ascaris lumbricoides* when exposed to metabolites the ovicidal fungus *Fusarium javanicum* var. *cicola*. 36 photographs of this anomalous elopment are included and the process is describ- in detail in 6 eggs.

M.R.N.S.

3—MALAKHOVA, E. I., 1967. [The effect of ygromycin B on the development of *Ascaris* eggs nd larvae.] *Byull. vses. Inst. Gel'mint. K. I. kryabina*, No. 1, pp. 75–77. [In Russian: nglish summary p. 77.]

—Buletin Stiinţific. Sectiunea de Ştiinte Medicale. Bucharest.

a. MARZA, V. D., UNGUREANU, E. & BOLDESCU, I., 1953.—" Cercetari asupra embrionarii oualor de *Ascaris lumbricoides* sub influenţa factorilor chimici şi fizici." [Study of the effect of various chemical and physical factors on embryonic development of eggs of *A. lumbricoides*.] 5 (3), 421–434.

—Zeitschrift für Biologie.

1. MEIER, W.—" Neuere Untersuchungen über die Wärmeentwicklung der Spulwürmer." XCI, 459-474.

—Dokladi Akademii Nauk SSSR.

. MIRETSKI, O. Y., 1952.—[The development of eggs of human Ascaris in various parts of the visible spectrum.] 82 (6), 1021–1024. [In Russian.]

(213c) In this paper Miretski gives the results of his experiments on the influence of -violet light and various parts of the visible spectrum on the development of ascarid eggs on the importance of yellow-brown pigment in the egg-shells of helminths. He used as filters a 1% solution of potassium bichromate, which absorbs the blue-violet part of pectrum and allows red to pass through, and a 4% solution of ammoniacal copper sulphate h absorbs the red half of the spectrum and allows ultra-violet to pass. The unpigmented (from the uterus) of *Ascaris lumbricoides* were placed in a narrow tube with Barbagall ion. The tubes were placed into larger tubes either with potassium bichromate or oniacal copper sulphate solution. They were cultured at room temperature in diffused and in direct sunlight. The eggs kept in diffused light in potassium bichromate developed rapidly than those in ammoniacal copper sulphate. Of those cultures placed in direct ght and in potassium bichromate 80% reached the infective stage, while of those in oniacal copper sulphate 93·4% reached only the 1 to 4 cell stage, and 6·6% achieved to 16 cell stage. 91·3% of the controls placed in the shade reached the infective stage. rding to Miretski the pigmented shell of the egg protects the embryo from the destructive n of both the ultra-violet and the violet rays of the visible part of the spectrum.

C.R.

931—PROBLEMI PARAZITOLOGII. [Transactions of the Scientific Conference of Parasitologists of the Ukrainian SSR.], 2nd (1956), 356 pp. [In Russian.]

931bi. MIRETSKI, O. Y., 1956.—[Influence of natural ultra-violet radiation on *Ascaris lumbricoides* eggs.] pp. 134–136.

(931bi) Studying the detrimental effect of direct sunlight on *Ascaris lumbricoides* eggs, Miretski has shown that when temperature and moisture content remain normal, the eggs are not killed by exposure to natural ultra-violet rays. Those reaching the earth are the long wave rays to which the eggs are less sensitive. The eggs are furthermore protected by their yellow-brown pigmentation. G.I.P.

2315—MOSKALEV, B. S. & RUBTSOVA, A. M., 1962. [The influence of external factors on the viability and infectivity of eggs of the pig ascaris.] **Zapiski Voronezhskogo Selskokhozyaistvennogo Instituta, 17** (2), 85–95. [In Russian.]

The effect of various temperatures on the rate of development, viability and infectivity of pig *Ascaris* eggs cultured in water or moist chambers was studied. Viability and infectivity were highest at 24 to 26°C. and those kept at 36 to 38°C. died within 4 days. N.J.

3375—MORI, S., 1957. [Department of Public Health, Faculty of Medicine, Tottori University, Yonago, Japan.] [Ecological study on *Ascaris* eggs. I. The influences of temperature and humidity on the development of *Ascaris* eggs.] **Journal of the Yonago Medical Association, 8** (1), 13–33. [In Japanese.]

Human ascarid eggs developed into larvae provided that the humidity was adequate. The hatching rate did not depend on temperature when its range remained between 20°C. and 34°C. At 20°C. development of larvae was possible between 80% and 100% relative humidity, and at 30°C. between 90% and 100%. Below this humidity the development of larvae never reached beyond a certain stage, depending on humidity, and eventually they died. The speed of larval development was influenced mostly by temperature. Under adequate humidity it took 28 days at 20°C. and 13 days at 30°C. for larvae to develop. Humidity also had some influence on the speed of the development. Y. Yamao

3376—MORI, S., 1957. [Department of Public Health, Tottori University, Yonago, Japan.] [Ecological study on *Ascaris* eggs. II. The resistance of *Ascaris* eggs to temperature and humidity.] **Journal of the Yonago Medical Association, 8** (1), 34–56. [In Japanese.]

Human ascarid eggs lived longer when the temperature was low and the humidity high. The effect of humidity was influenced by temperature. At high temperatures with low humidity eggs died quickly. No difference in resistance to temperature and humidity was noted between human and pig ascarid eggs. Y. Yamao

3377—MORI, S., 1957. [Department of Public Health, Faculty of Medicine, Tottori University, Yonago, Japan.] [Ecological Study on *Ascaris* eggs. III. Experiments on *Ascaris* eggs exposed intermittently to moist and dry conditions for a definite period.] **Journal of the Yonago Medical Association, 8** (1), 57–66. [In Japanese.]

The effect of intermittent drying on *Ascaris* eggs was determined by the duration of drying, degree of dryness and temperature. Y. Yamao

3825—MÜNNICH, H., 1965. "Beziehungen zwischen dem Fett- und Glykogengehalt von *Ascaris*-Larven und der Dauer ihrer Infektionsfähigkeit." **Zeitschrift für Parasitenkunde, 25** (3), 231–239.

Münnich kept pig *Ascaris* eggs in the laboratory for 4 years; the number surviving and remaining infective was greatly reduced during this time. Freshly developed larvae had large stores of fat and glycogen, but during the course of 4 years the fat stores disappeared; the glycogen store remained constant for the first 3 years and diminished during the 4th year. He relates the loss of infectivity to the reduction in food reserves. H.D.C.

3866—NEIFAKH, A. A. & RASS, I. T., 1960. [Institut morfologii zhivotnikh imeni A. N. Severtsova, Akademiya nauk SSSR.] [Study by radiation of the morphogenic activity of nuclei in the embryonic development of *Ascaris suum*.] **Dokladi Akademii Nauk SSSR, 135** (6), 1557–1560. [In Russian.]

Neifakh & Rass having subjected *Ascaris suum* eggs to ionizing radiation at doses which affected the nuclei to the point of inactivation but left the cytoplasm intact, conclude that the morphogenic activity of the nuclei begins from the two-blastomere stage. N. Jones

1160—NENOW, S., 1960. [Institute of Parasitology, Sofia, Bulgaria.] "Wpływ promieni słonecznych na jaja *Ascaris lumbricoides* przy różnych wysokościach nad poziomem morza." **Wiadomości Parazytologiczne, 6** (2/3), 189–196. [English summary p. 196.]

The effect of direct sunlight was investigated on fresh and infective *Ascaris lumbricoides* eggs at different altitudes (0 to 2,376 m. above sea level) in an area approximately between 22° to 28° East and 41° to 44° North. Eggs on cellophane paper were put in a small glass crystallizer, immersed in a container of water of given temperature (12–15°C. or 25°C.), placed outside during July and August from 8 a.m. onwards and examined for viability every 30 min. for up to 480 min. The tabulated results show that the sun was most quickly lethal between 11 a.m. and 1 p.m., when it was richest in ultra-violet light, but did not kill the eggs in the afternoon. At mid-day the fresh eggs were killed in 300 to 390 min. at the lower altitudes and in 210 to 240 min. at 2,376 m., while infective eggs were killed in 390 to 450 min. and in 240 to 300 min. respectively.

G. I. Pozniak

1868—NIKOLAEV, S. M., 1968. [The effect of plant root exudates on the development of pig *Ascaris* ova.] *Zool. Zh.*, **47** (12), 1860–1861. [In Russian: English summary p. 1861.]

The effect of the root exudates of barley, vetch, pea, wheat, soya bean, oat and rye on the development of *Ascaris suum* ova was studied. The development proceeded normally in the autumn and did not occur in the summer.

J.A.D.

854—Studii si Cercetări de Inframicrobiologie, Microbiologie si Parazitologie. Bucharest.

a. NITZULESCU, V., SORESCU, A. & PANAITESCU, D., 1956.—"Contribuţii la studiul condiţiilor necesare dezvoltării ouălor de *Ascaris* şi trichocefal." **7** (3/4), 553–561. [French & Russian summaries pp. 559–560.]

(854a) From laboratory experiments the authors conclude that eggs of *Ascaris lumbricoides* and *Trichuris trichiura* develop better at 20°C. than at 29°C. or 37°C. and more quickly in 2% agar than in 0·2% agar. The trichurid eggs develop better at 100% humidity but those of *Ascaris* at lower values.

G.I.P.

101—American Journal of Hygiene.

c. NOLF, L. O.—"Experimental studies on certain factors influencing the development and viability of the ova of the human trichuris as compared with those of the human ascaris." XVI (1), 288-322, 8 figs., 8 tables, 27 refs. [July, 1932.]

(c) An account is given by Nolf of some physical factors affecting the survival and development of Trichuris and Ascaris ova.

The gas exchange in developing *Trichuris trichura* ova is discussed. In the early stages of development R.Q. is high but falls from unity to 0.75 in 15 days, after which it rises slightly to 0.80 in the next 5 days. He discusses these figures in the light of previous data obtained from hookworm and *Ascaris megalocephala*. The nitrogen content does not vary, supporting the view that the " fibrous membrane " is impermeable to it.

Other experiments show that the oxygen requirements of Trichuris ova are not different from those of Ascaris. Trichuris are more affected by partial dryness of the atmosphere and succumb more quickly to complete dessication than Ascaris. The range of temperature under which Trichuris can develop is smaller than that of Ascaris.

Finally the effect of ultra-violet light is considered. Here Trichuris eggs were more resistant: the brown pigmentation of the shell probably affording some degree of protection.

P.A.C.

339—Nisshin Igaku.

*a. OCHI, S., 1932.—[Experimental studies on the development of the eggs and infective route of *Ascaris* in nature.] **21** (5), 733–784. [In Japanese.]

514—OHZU, S., 1961. [Studies on ascaris eggs exposed to anaerobic conditions for some time at high temperatures.] **Japanese Journal of Parasitology, 10** (2), 221–239. [In Japanese: English summary p. 239.]

The growth of eggs of *Ascaris lumbricoides* from pigs stopped when they were kept without oxygen at 30°C. The effects of temperatures of 35°C. to 45°C. were also studied. When eggs were exposed to anaerobic conditions at 30°C. they survived for 150 days but none survived after 170 days. At 40°C. the eggs survived for 22 days without oxygen but for only ten days with oxygen. When the eggs were mixed with living bacteria their growth ceased while the bacteria remained alive but recommenced when the micro-organisms were killed by 1% formalin. Ohzu concludes that the eggs with living bacteria stopped growing because the oxygen in the medium was consumed by the micro-organisms.

Y.Y.

375—OHZU, S., 1961. [Study on the culture of ascaris eggs with special reference to a comparison of the slant agar medium with other culture media.] **Japanese Journal of Parasitology, 10** (2), 240–248. [In Japanese: English summary p. 248.]

701—OYA, H., COSTELLO, L. C. & SMITH, W.N., 1963. "The comparative biochemistry of developing *Ascaris* eggs. II. Changes in cytochrome C oxidase activity during embryonation." *J. cell. comp. Physiol.*, **62** (3), 287–293.

Cytochrome c activity was first detected during the development of *Ascaris* eggs at the 32–64-cell stage. It increased in the gastrula stage and remained constant till the time of moulting into the second larval stage. It again rose during the development of the second larva. The marked increase in activity in the second stage was not associated with an increase in respiration. W.P.R.

210[illegible]—OYA, H., COSTELLO, L. C. & SMITH, W[illegible] 1963. "Succinate and malate oxidation and cytochrome c reduction in embryonated and unembryonated *Ascaris* eggs." [Abstract.] **Journal of Parasitology, 49** (5, Sect. 2), 51.

[A full account of this work appeared in *Archs Biochem. Biophys.*, 1963, **103**, 345–351; for abstract see Helm. Abs., **33**, No. 2955.]

1443—PAHL, G. & BACHOFER, C. S., 1957. [St. Mary's College, Winona, Minnesota, U.S.A.] "Anaerobic recovery of *Ascaris* eggs from X-irradiation." **Biological Bulletin, 112** (3), 383–389.

Pahl & Bachofer describe experiments showing that X-irradiation of *Ascaris suum* eggs produces delay of cell cleavage and reduces the percentage of eggs that complete embryogenesis; that anaerobic treatment of eggs after irradiation followed by aerobic incubation reduces the time required for cleavage and increases the percentage that completes embryogenesis; and that post-irradiation treatment with cyanide produces recovery effects similar to those secured with anaerobiosis. A cytochrome system in the eggs was demonstrated. The significance of these results is discussed. J. M. Watson

364—Canadian Journal of Biochemistry and Physiology.

a. PASSEY, R. F. & FAIRBAIRN, D., 1955.—"The respiration of *Ascaris lumbricoides* eggs." **33** (6), 1033–1046.

(364a) Passey & Fairbairn showed that the rate of oxygen consumption of "decoated" eggs of *Ascaris lumbricoides* fell during the first one-and-a-half days of development at 30°C. and then rose to a maximum of about 0·8 μl. per mg. dry weight per hour after 10 days. Thereafter, although the eggs remained viable the rate fell until oxygen uptake was scarcely measurable after 140 days. Respiration was inhibited by cyanide and azide. Carbon monoxide inhibited strongly in the dark but not in the light. The Q_{O_2} fell rapidly when the P_{O_2} was reduced below about 80 mm. of mercury. However, cytochrome *c* and cytochrome oxidase could not be detected in the eggs. W.P.R.

*3197—PETERKOVÁ, I., 1967. "Príspevok k otázke perzistencie vajíčok *Ascaris lumbricoides* a *Trichocephalus trichiuris* v pôde." [A contribution on the persistance of *A. lumbricoides* and *Trichuris trichiura* eggs in soil.] *Čslkd Hyg.*, **12** (10), 612–618. [English summary.]

1372—PIĄTKOWSKA, W., 1966. "Badania nad przezwyalnością i rozwojem jaj geohelmintów sztucznie wprowadzonych do gleby." *Wiad. parazyt.*, **12** (1), 47–55. [English summary p. 55.]

Eggs of pig *Ascaris*, at two stages of development, when placed on experimental plots in the Baltic Coast area of Poland in November, 1963, were able to survive the winter. Examination the following March showed that 61% of the unsegmented eggs were capable of development and that in 54 to 81% of eggs with larvae, the larvae were viable. Eggs reaching the soil in the spring became infective at the beginning of July. G.I.P.

260—Mikroskopie. Vienna.

a. PIRINGER, W. & PIRINGER, E., 1956.—"Photostudie über die Entwicklung der Eier von *Ascaris lumbricoides*." **10** (9/10), 349–352. [English summary p. 352.]

(260a) When faecal samples are collected and preserved during warm weather, eggs of *Ascaris lumbricoides* undergo some development. To assist in the recognition of the different phases, from the commencement of segmentation to the filariform larva, ten photographs are reproduced and these are described in the text. R.T.L.

422—PITTS, T. D. & JOHNSON, P. C., 1964. "Inhibition of cell division in *Ascaris suum* eggs in utero." [Abstract.] *J. Parasit.*, **50** (3, Sect. 2), 55–56.

3527—PLAAN, O. Y., 1961. [Effect of some physical, climatic and chemical factors on eggs of *Ascaris suum* (Goeze, 1782.)] In: Lesinsh, K. P. [Editor], [Problems in parasitology in the Baltic Republics.] *2nd Conference, Riga*, March 1960. **Proceedings, pp. 107–110. [In Russian.]**

5242—PRZYJAŁKOWSKI, Z. & JASKOSKI, B. J., 1968. "Action of intestinal bacteria on *Ascaris suum* eggs." *Bull. Acad. pol. Sci. Cl. II. Sér. Sci. biol.*, **16** (11), 711–713.

Experiments showed that some monocultures of intestinal bacteria had an ovostatic effect on the *in vitro* development of fertile *Ascaris suum* eggs.

C.W.G.

389—SAITO, I., 1959. [Department of Public Health, Faculty of Medicine, Kyushu University, Fukuoka, Japan.] [Development of *Ascaris* eggs discharged from febrile patients.] **Igaku Kenkyu. Fukuoka, 29** (2), 327–339. [In Japanese: English summary p. 339.]

The development of human *Ascaris* eggs was inhibited when they were kept at 38°C. for seven days, 39°C. for five days, 40°C. for four to five days and 41°C. for three to four days. Within the limit of human body temperature during pyrexia, an inhibitory effect on the development of the eggs was not observed. When the eggs were exposed to a high fever longer than a certain length of time, the higher the temperature the shorter the time required to produce an inhibiting effect on them. Accordingly, *Ascaris* eggs obtained from the faeces of febrile patients were investigated. The eggs which had not remained long in the intestine (dysentery) showed a normal development while those which had stayed longer in the intestine (encephalitis japonica) showed no larval development.

Y. Yamao

1167—SAITO, S., 1960. [Department of Parasitology, School of Medicine, Keio University, Tokyo, Japan.] [Studies on the respiratory metabolism of *Ascaris* eggs. 2. Effect of inhibitors and cobalt-60 irradiation on methylene blue decolorization activity of *Ascaris* eggs.] **Japanese Journal of Parasitology, 9** (3), 232–238. [In Japanese: English summary p. 238.]

The effect of some respiratory inhibitors and irradiation with radio-active cobalt-60 on the respiration of *Ascaris* eggs was studied. Among the inhibitors tested, pentachlorophenol was most effective showing a complete inhibition at a concentration of M/5,000 and 56% inhibition even at M/50,000. With cobalt-60 irradiation, small doses (under 320 × 10r.) stimulated the methylene blue decolorization activity but large doses (820 × 10r.), however were inhibitory.

Y. Yamao

1168—SAITO, S. & KAWAZOE, Y., 1960. [Department of Parasitology, School of Medicine, Keio University, Tokyo, Japan.] [Studies on the respiratory metabolism of *Ascaris* eggs. 1. Relation between the developmental stages of the eggs and the methylene blue decolorization activity.] **Japanese Journal of Parasitology, 9** (3), 227–231. [In Japanese: English summary p. 231.]

The methylene blue decolorization activity of homogenized eggs of *Ascaris lumbricoides* in various developmental stages, was evaluated by Thunberg's method with sodium succinate as substrate. The maximum rate of decolorization was at *p*H 9·4. The optimum temperature for decolorization was 30°C. The highest activity was recognized in eggs at the morula stage.

Y. Yamao

313—Journal of Parasitology

†u. SEAMSTER, A., 1948.—"Humidity requirements of *Ascaris lumbricoides* var. *suum* ova." **34** (6, Sect. 2), Suppl. p. 21.

(313u) The humidity requirements of the eggs of *Ascaris lumbricoides* var. *suum* are higher than previously reported. Ova smeared on glass and exposed to air of 80%, 85% and 95% humidity at 31·1°C. failed to develop beyond the morula stage and after eight days' exposure were desiccated beyond recovery. At a constant relative humidity of 95% at 26·7°C. and 28·9°C. they required 8% more time to complete their development than controls kept at 100% relative humidity.

R.T.L.

49—American Midland Naturalist.

a. SEAMSTER, A. P., 1950.—"Developmental studies concerning the eggs of *Ascaris lumbricoides* var. *suum*." 43 (2), 450–470.

(49a) Seamster has made a detailed study of the temperature and humidity requirements of the eggs of *Ascaris lumbricoides* var. *suum* using a "Climatizer" unit and a work chamber with an externally located, electrically operated thermograph, which accurately recorded conditions inside the chamber for each 24-hour period without opening the doors. The optimum temperature for embryonation of Ascaris eggs was found to be 31·1°C. (88°F.) and the time required was 200 hours. The maximum temperature was 34·4°C. but only 10% developed to the motile-embryo stage; 316 hours were required. Exposure at 37·8°C. proved lethal in eight days. Eggs smeared on glass slides and exposed to relative humidities of 80%, 85% and 95% at 31·1°C. developed only to the morula stage and were desiccated beyond recovery after eight days under these conditions. At a relative humidity of 100% at 31·1°C. eggs developed at the same rate as in water at the same temperature. The daily egg production of 16 worms *in vitro* ranged from a minimum daily average of 19,400 to a maximum daily average of 475,000. The eggs were killed in at least three days by exposure to fumes of concentrated ammonium hydroxide. Development was not affected by D.D.T. (50%), sulphanilamide solutions (1% and 2%), ammonium sulphate, ammonium chloride or ammonium nitrate at a constant temperature of 31·1°C. R.T.L.

242—Medical Parasitology and Parasitic Diseases.

m. SHIKHOBALOVA, N. P. & GORODILOVA, L. I., 1944.—[The effect of the ultraviolet part of the sun spectrum on the eggs of Ascaris.] 13 (6), 69–71. [In Russian.]

(242m) In order to determine the effect of the ultraviolet rays of the sun on eggs of *Ascaris lumbricoides*, the authors exposed to the sunlight 4 samples of eggs. The first were left uncovered on moist sand; the second were covered with plain glass; the third with a light yellow filter and the fourth with a dark green filter. The eggs in the first 2 dishes died, while those in the third and fourth dishes 90 to 94% developed up to the infective stage. In a control sample not exposed to the sunlight 96 to 98% of eggs developed to the infective stage. C.R.

255—Meditsinskaya Parazitologiya i Parazitarnie Bolezni. Moscow

ba. SHIKHOBALOVA, N. P., VASILKOVA, Z. G. & SHEKHTMAN, Y. L., 1958.—[A study on radio-sensitivity of eggs of *Ascaris lumbricoides* and *Ascaris suum*, and viability of the larvae.] 27 (5), 566–571. [In Russian: English summary pp. 570–571.]

(255ba) The effect of irradiation with X-rays or gamma rays from Co^{60} of *Ascaris lumbricoides* and *A. suum* eggs before cleavage depended on the irradiation dose. 100% to 60% of larvae developed to the infective stage after irradiation with 2,000 to 15,000 roentgen, 5–26% developed after 30,000 roentgen and all eggs were killed by 40,000 roentgen of X-rays, gamma rays being somewhat less effective. The development of larvae was generally retarded (evident already at 7,000 roentgen) and those that did develop were less infective, considerably smaller numbers reaching the liver and lungs of experimentally infected white mice than in the controls which had received non-irradiated larvae. G.I.P.

1999—SHIKHOBALOVA, N. P., VASILKOVA, Z. G., SHEKHTMAN, Y. L. & VINOGRADOVA, I. D., 1958. [Gelmintologicheskaya laboratoriya, Akademiya nauk SSSR.] [Change in the irradiation sensitivity of eggs of some Ascaridata in relation to the stage of embryogenesis.] **Papers on Helminthology presented to Academician K. I. Skryabin on his 80th Birthday. Moscow: Izdatelstvo Akademii Nauk SSSR**, pp. 400–406. [In Russian.]

Shikhobalova *et al.* irradiated with roentgen and gamma rays of Cobalt 60 the eggs of *Ascaris lumbricoides*, *A. suum* and *Ascaridia galli* at various stages of development, ranging from one blastomere to that of infective larva. The eggs were most sensitive at the blastula, morula and early gastrula stages, as judged by the number of infective larvae and their ability (which was reduced) to migrate within the host. This ability was more affected when *Ascaris suum* and *A. lumbricoides* eggs were irradiated at the one blastomere stage than after embryogenesis was completed. Post-embryonic development was affected by irradiation and as a result the percentage of females was increased. N. Jones

598—SKRIPKA, L. I., 1964. [Effect of culture solution of Actinomycetes on *Ascaris* eggs.] *Medskaya Parazit.*, 33 (6), 685–689. [In Russian: English summary p. 689.]

Of 145 strains of Actinomycetes extracted from soil in the Ukraine 41 strains, chiefly of *Coerulescens* and *Violaceus*, depressed development of pig *Ascaris* eggs and reduced the infectivity of larvae, resulting in smaller numbers migrating to the lungs in mice. S.M.

342—SMITH, W. N. & COSTELLO, L. C., 1965. "Effect of inhibitors on terminal oxidation of *Ascaris* egg preparations." [Abstract.] *J. Parasit.*, 51 (2, Sect. 2), 57.

2827—SORESCO, A., PANAITESCO, D., CIUREA, C. & IANCO, L., 1961. "L'étude de l'embryogénèse des oeufs d'*Ascaris lumbricoides* dans des conditions variées d'oxygénation du milieu." **Archives Roumaines de Pathologie Expérimentale et de Microbiologie, 20** (1), 129–136. [English, German & Russian summaries pp. 135–136.]

173—Journal of Parasitology.

d. SPINDLER, L. A., 1940.—" Effect of tropical sunlight on eggs of *Ascaris suis* (Nematoda), the large intestinal roundworm of swine." 26 (4), 323-331.

(173d) It is shown experimentally that the eggs of *Ascaris lumbricoides*, from pigs, fail to survive comparatively short exposure to tropical sunlight, apart from heat, when exposed in shallow water. Those in advanced stages of development were noticeably more resistant than unsegmented eggs. None of the eggs exposed in a dried condition survived 4½ hours: those in late segmentation stages were somewhat more resistant than those in the early segmentation stages, where none survived longer than 1½ hours. Over 95% of the controls survived. The long survival of some Ascaris eggs under natural conditions, even in a tropical environment, is probably attributable to the protection of the surrounding faeces. R.T.L.

138—Indian Journal of Medical Research.

a. STEWART, F. H.—" A method of incubating ascaris eggs." XXII (1), 1. [1934.]

(a) Stewart describes a method of culturing ascaris eggs in which he spreads them evenly over the inner surface of a test-tube. A little water is left in the bottom of the tube which is then corked, leaving the eggs in a damp atmosphere very suitable for segmentation to proceed. P.A.C.

346—SYLK, S. R., 1965. "Infectivity of artificially embryonated eggs and hatched larvae of *Ascaris suum*." [Abstract.] *J. Parasit.*, 51 (2, Sect. 2), 49.

753—Osaka Daigaku Igaku Zassi.

b. TAKEYAMA, O., 1952.—[Influence of human urine upon the development of the eggs of *Ascaris lumbricoides* (Report II).] 5 (2), 201–210. [In Japanese: English summary p. 201.]

c. TAKEYAMA, O., 1952.—[Influence of human urine upon the development of the eggs of *Ascaris lumbricoides*, with special reference to its ovicidal action (Report III).] 5 (2), 211–221. [In Japanese: English summary p. 211.]

(753b) The effect of human urine on the development of the eggs of *Ascaris lumbricoides* differs according to the type of urine. Indicanuria is remarkably lethal to the eggs. The higher the specific gravity of urine, the greater its power to injure the eggs but the *p*H of the urine showed no such relationship. R.T.L.

(753c) Takeyama now discusses the results of his earlier experiments on the effect of various types of urine on the development of *Ascaris lumbricoides*. The conclusions drawn are that the ammonia in human urine of normal concentration does not check the development of the eggs. The ovicidal action of uraturia, indicanuria and some normal urines is due to their ammonia content. Human urine kills the eggs when its urea concentration is over 1·0 gm. per 100 c.c. R.T.L.

658—TIMOSHIN, D. G., 1967. [The times and rate of development of *Ascaris lumbricoides* eggs.] *Medskaya Parazit.*, 36 (3), 333–340. [In Russian: English summary p. 340.]

Development of *Ascaris* ova occurs at temperatures between 13 and 36°C. with optimal temperatures between 17 and 30°C. A formula for calculating the likely length of development from a summation of daily temperatures is suggested. Between 17 and 30°C, the rate of development is directly proportional to the temperature and the sum of temperatures during the developmental period is constant and equals 300. G.I.P.

3553—TIMOSHIN, D. G. & CHEFRANOVA, Yu. A., 1968. [Influence of physical and biological agents on the ascaris eggs and soil self-purification of eggs.] [Abstract.] *Int. Congr. trop. Med. Malar.* (8th), *Teheran*, Sept. 7–15, 1968. Abstracts and reviews, pp. 211–213. [In Russian.]

398—URABE, K., 1958. [Department of Public Health, Faculty of Medicine, Kyushu University, Fukuoka, Japan.] [Difference of resistance against heating between *Ascaris* eggs in faeces and uterus.] **Igaku Kenkyu. Fukuoka, 28** (3), 630–651. [In Japanese: English summary p. 651.]

The resistance of the eggs obtained from the uterus of *Ascaris lumbricoides* to heating at 50°C. for 10 to 30 minutes was markedly less than that of eggs collected from the faeces. The weak resistance of the uterine eggs was not due to the absence of faecal matter but appeared to be due to prematurity; eggs discharged from females in culture fluid were more resistant to heat than eggs extracted from the uterus. Y. Yamao

2171—WILSON, P. A. G., 1967. "Physiological adaptation and partial dormancy in *Ascaris* eggs." [Correspondence.] *Nature, Lond.*, **213** (5077), 715–717.

Stages of organisms having metabolic characteristics approaching dormancy, e.g. infective pig *Ascaris* eggs, are ideal for the study of physiological adaptation to temperature change. Eggs were analysed before and after acclimatization to different temperatures, to assess the economic advantage conferred by the adaptation seen in the metabolic rate. T.Y.

91—American Journal of Tropical Medicine.

b. WILSON, P. W., 1942.—" Maturation of Ascaris ova in sea water; a possible factor in dissemination of ascariasis in American Samoa." **22** (3), 305–307.

(91b) Wilson seeks to correlate the dissemination of faeces on beaches and the " dunking " of cooked food in fresh sea-water with the high incidence of Ascaris infections in coastal villages of Samoa. He suggests the possibility of Ascaris eggs being able to develop to the infective stage in the sea and records that Ascaris ova can develop into mature active larvae in aerated sea-water containing 2% formalin. He reports the recovery of live Ascaris and Trichocephalus ova from shallow pools in the coral at low tide. It is suggested that beach latrines are a contributory factor to the spread of infection, tables being given which tend to support this view. D.W.F.

22—Experimental Parasitology. New York.

c. YAMAGUTI, S., INATOMI, S. & KIMURA, M., 1955.—" Recovery of a chemical fraction from human nightsoil having an ovistatic effect upon *Ascaris lumbricoides* eggs." **4** (1), 29–33.

(22c) Yamaguti *et al.* have examined extracts of a 1:4 mixture of human faeces and urine for ovistatic effects on *Ascaris lumbricoides* eggs. A fraction which was insoluble in ether and ethanol, but soluble in acetone and water, was found to inhibit development. W.P.R.

g. YAMAGUTI, S., INATOMI, S. & KIMURA, M., 1955.—" Experimental studies on ovicidal substances occurring in human nightsoil." **4** (2), 87–91.

(22g) Yamaguti *et al.* have shown that a mixture of human nightsoil, raw fish viscera and superphosphate of lime, inoculated with *Escherichia coli*, is markedly ovicidal to eggs of *Ascaris lumbricoides*. An acetone insoluble fraction of an acidulated faecal mixture was ovistatic but not ovicidal. S.W.

723—YANAGISAWA, T., 1965. "The respiratory metabolism of *Ascaris* eggs with special reference to the effects of cyanide and temperatures on the oxygen uptake of late developmental stages." *Jap. J. med. Sci. Biol.*, 18 (1), 33–44.

The effect of cyanide and temperatures of 30°C. (optimal egg culture temperature) and 37°C. (host temperature) on the endogenous respiration of *Ascaris* eggs, cultured for 10 days or more, was tested. Storage of unembryonated pig *Ascaris* eggs at 5°C. for 1, 7 and 62 days had very little effect on the later oxygen consumption of these eggs at 30°C. The change in respiratory rate during embryonation reported by Passey *et al.* in 1955 [see Helm. Abs. 24, No. 364a] was reinvestigated by means of the Warburg technique. The graphed and tabulated results show that the rate of oxygen consumption during embryonation at 30°C. was 12·7µl. per hr. per million eggs; this decreased gradually with age to a minimum of about 0·5µl. at 45 hr. 45-hr.-eggs consisted of unsegmented and 2-cell eggs in the proportion of 36 : 34, and more than 95% remained unsegmented between 10 and 32 hr. From 45 hr. onward the respiratory rate increased to about 20µl. by the 8–14th day, when the eggs developed from the 2-cell stage to the tadpole or more advanced embryo. This maximum was followed by a gradual decrease to about 4·0µl. on the 30–35th days. The inhibiting effect of cyanide on the oxygen consumption at 30°C. and 37°C. of embryonated eggs was observed at 5-day intervals from the 10–35th day. Results at 30°C. show that 60–90% inhibition occurred at 10 and 15 days. From 20 days onward the endogenous respiration rates were too low for calculation to be made. At 37°C. the inhibition increased, generally, with the duration of exposure. Sensitivity to cyanide decreased as the age of the egg increased. These results are very close to those obtained by Passey *et al.* (1955) and the authors discuss why results obtained by workers before those may be considered unreliable. Further physiological and biochemical investigation of egg response to 37°C. is recommended. L.E-L.

1176—YANAI, T., 1960. [Department of Parasitology, Research Institute for Microbial Diseases, Osaka University, Osaka, Japan.] [Studies on the behaviour and fate of various ascarid eggs placed outside the intestine of the host. 3. On the development of the eggs of *Ascaris lumbricoides* from swine in the peritoneal cavities of poikilothermal animals.] **Japanese Journal of Parasitology,** 9 (1), 32–41. [In Japanese: English summary p. 41.]

A factor influencing development of the eggs of *Ascaris lumbricoides* from pigs within the human body was studied by inoculating them into the peritoneal cavity of frogs, *Rana nigromaculata*, and Japanese goldfish. In frogs at an outdoor temperature of 30°C. to 32°C., 10% of the inoculated eggs were found embryonated after 14 days and 90% after 21 days. In the goldfish, at a water temperature of 26°C. or 29°C. to 30°C., 2% to 3% of them were found to be embryonated when examined after 21 or 28 days. Y. Yamao

2230—YEN, W. C. & CHEN, S. P., 1964. [Studies on the development and viability of the eggs of pig *Ascaris* (*Ascaris suum* Goeze, 1782) under natural conditions in Peking.] *Acta zool. sin.*, 16 (3), 416–422. [In Chinese: English summary p.422.]

The development and viability of pig *Ascaris* eggs buried in loam at depths of 0 to 20 cm. in both sunny and shady conditions were studied. At depths of 0 to 3 cm., eggs in sunny conditions died due to the low moisture content (below 5%) or high temperature (above 42°C.). At 3 to 20 cm. depth optimum development took place at temperatures of 26·3 to 33·3°C. and moisture contents of 9·5 to 19%. In sunny conditions eggs developed from April to October; in shade, development took place from May to September, but eggs maintained their viability during the winter. [From English summary.] M.R.N.S.

4466—ZELENOVA, I. G., 1968. [Survival rate and periods of development of ascarid eggs in the soil in the Kemerov region.] *Mater. nauch. Konf. vses. Obshch. Gel'mint.*, Year 1967, Part 2, pp. 132–135. [In Russian.]

ANNOTATED BIBLIOGRAPHIES

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2 *Taenia saginata* and *T. solium* in Lebanon, Turkey and Yugoslavia.
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3 Helminthology in Iraq.
71 references covering 1932—1969. £0.70 ($1.80)

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8 Factors influencing the development of *Ascaris* eggs.
120 references covering 1932—1971. £1.20 ($3.10)

9 Helminths in archaeological and pre-historic deposits.
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